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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,260	02/06/2004	Toshihiro Ifuku	03500.017882	4439

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EXAMINER

AGUIRRECHEA, JAYDI A

ART UNIT	PAPER NUMBER
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2834

DATE MAILED: 02/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/772,260	Applicant(s) IFUKU ET AL.	
	Examiner Jaydi A. Aguirrechea	Art Unit 2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 November 2005.
 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 1-25 is/are rejected.
 7) ☐ Claim(s) _____ is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☒ The drawing(s) filed on 23 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

1. The drawings were received on 11/23/05. These drawings are acceptable.

Specification

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyun et al. (Non-Patent Literature: "Anisotropic tuning behavior in epitaxial $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{TiO}$ thin films, Appl. Physics Letters, Volume 77, number 19, 6 November 2000, pp. 3084-3086)

Hyun discloses a ferroelectric thin film element comprising a substrate and an epitaxial ferroelectric thin film is provided on said substrate, wherein said epitaxial ferroelectric thin film satisfies a relation $z/z_0 > 1.003$. Specifically, Hyun discloses the values of z and z_0 being: $z=3.958\text{\AA}$ and $z_0=3.947\text{\AA}$; and the ratio $z/z_0 > 1.003$ is satisfied.

Hyun is silent regarding the values of x and x_0 .

However, oxide thin films are usually grown on substrates that offer the smallest mismatch with the desired structure of the film. Therefore, it would have been obvious at the

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time of the invention was made to grow a ferroelectric film on a substrate wherein the ferroelectric film satisfies the relation $0.997 < x/x_0 < 1.003$ since it is desirable to match the structure of the film with the substrate.

With regards to claims 5 and 6, these are not structural limitations and therefore were given little patentable weight.

With regards to claim 7, Hyun discloses the ferroelectric film being SBT, which is known to have a perovskite structure.

With regards to claim 8, $(\text{Sr},\text{Br})\text{TiO}_3$ film includes an oxygen atom as a constituent atom.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hyun et al.

Hyun discloses the claimed invention where the epitaxial ferroelectric film has a thickness of 600nm, but fails to disclose the epitaxial ferroelectric thin film having a thickness within a range of 2 to 100 nm.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to design a thin film having a thickness of 2-100nm since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. In this case, it would have been obvious since the dimensions of the layers determine the overall dimensions of the device itself, and having a smaller thickness will result in a smaller device.

6. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyun et al. in view of Higuchi et al. (US 2002/0155666, also US 6930339).

Hyun discloses the claimed invention as explained above, but fails to disclose the use of a buffer layer disposed between the substrate and the ferroelectric film.

Higuchi discloses a ferroelectric layer formed on a silicon crystal substrate via a buffer layer. Higuchi's invention has the advantage of providing a ferroelectric memory having superior memory characteristics.

Therefore, it would have been obvious at the time of the invention was made to use a buffer layer between the ferroelectric film and the substrate in order to improve the memory characteristics of the device.

With regards to claim 4, Higuchi discloses the buffer layer comprising a metal oxide (e.g. MgO), which is an electro-conductive material.

7. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyun et al.

Hyun discloses the claimed invention having a ferroelectric layer but fails to disclose the film having a rhombohedral, hexagonal or rhombic structures having the crystal orientations (001), (111), (0001) and (110) respectively.

The Examiner takes Official Notice that it is well known in the art of piezoelectrics to use specific crystal structures and orientations in different devices for the purpose of improving crystal/dielectric properties of the devices.

Therefore, it would have been obvious at the time of the invention was made to grow ferroelectric layers having specific structures and orientations that matches that of the substrate to improve the crystal/dielectric properties of the devices.

8. Claims 13-25 are rejected based on the same grounds of rejection as explained above.

Claim 13 is an actuator using the ferroelectric element claimed in claim 1 and claim 25 is a liquid discharge head using the piezoelectric actuator claimed in claim 13. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed

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does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex Parte Masham*, 2 USPQ F.2d 1647 (1987). In this case, the combination of Hyun and Higuchi disclose the claimed invention.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See PTO-892.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jaydi A. Aguirrechea whose telephone number is 571-272-2018. The examiner can normally be reached on M-Th 9-7.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Darren E. Schuberg can be reached on 571-272-2044. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JAA
2/4/06

DARREN SCHUBERG
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800